Dehcho Boreal Caribou Study Progress Report, April 2008

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Background

In response to the new federal Species at Risk Act (SARA) and following extensive consultation with the Sambaa K'e Dene Band (SKDB) of Trout Lake, the Department of Environment and Natural Resources (ENR), Dehcho Region initiated an ecological study of boreal caribou in the Trout Lake area during the spring of 2004. SKDB saw the benefits of combining information from this study with their own traditional knowledge study (Yúndíit'qh TEK study) to fill information gaps about boreal caribou. An initial ten female boreal caribou were collared in the Celibeta Lake area in order to document seasonal range use and movements, calving period/locations, and fidelity of seasonal range use over a 4-5 year period. Collared females would also provide population information on calf production, calf survival, and adult female survival. Other ecological studies of boreal caribou had been initiated in other regions of the Northwest Territories to increase knowledge of boreal caribou throughout their range so that in the face of increasing development pressures informed decisions regarding land use could be made.

Because snow conditions restricted caribou distribution in 2004, at the request of SKDB an additional 8 satellite collars were deployed on female boreal caribou in spring 2005. Subsequently, SKDB requested an additional 4 collars be deployed on female boreal caribou in their study area in January 2006. Previous annual progress reports of the Trout Lake Caribou Study have been published (Larter and Allaire 2005; 2006a: 2007) and provide more detailed information. Results have been used in support of the Sambaa K'e Candidate Protected Area.

In response to the requests and after extensive consultations with the Fort Simpson Métis Local (FSML) and Liidlii Kue First Nations (LKFN), ENR Dehcho Region initiated an ecological study of boreal caribou in the Ebbutt Hills area in spring 2005 when 5 satellite collars were deployed on female boreal caribou. The study area included portions of the proposed Mackenzie Gas Pipeline; study objectives were similar to the Trout Lake study. Subsequently, at the requests of Jean Marie River First Nation (JMRFN), Pehdzeh Ki First Nation (PKFN) in Wrigley, and Nahanni Butte Dene Band (NBDB), the Ebbutt Hills study area was expanded and an additional 9 collars (5 satellite and 4 VHF) were deployed in the study area in January 2006. A previous progress report of the Ebbutt Hills Study has been published (Larter and Allaire 2006b; 2007) which provides more detailed information.

Boreal caribou do not respect study area boundaries and collars have been deployed on female boreal caribou throughout the Dehcho Region with continued support of local First Nations. At the 3rd biannual Dehcho Regional Wildlife Workshop in Fort Simpson (October 2006) it was decided to treat all the boreal caribou work as one larger study. This progress report combines the background information and updates the results of the previously combined Trout Lake and Ebbutt Hills boreal caribou studies. Including the more recent deployments of 17 collars (8 satellite and 9 GPS) in January 2007 and 8 collars (4 satellite and 4 GPS) in February 2008.

Collar Descriptions

Collars have been deployed annually since 2004. All collars have a very high frequency (VHF) beacon so they can be relocated from the ground or air with a receiver and antenna system (Fig. 1). Satellite collars (Telonics ST-20; Fig. 2) are programmed to provide daily locations from 1 May to 14 June (the anticipated calving period) and locations once every 3 days for the remainder of the year with a life span of 3-4 years. Satellite collars deployed after March 2004 are equipped with release mechanisms that allow the collars to be removed remotely without the need to recapture animals.

GPS collars (Telonics TGW-3680; Fig. 3) were deployed in January 2007 and February 2008. GPS collars provide 3 locations daily, with a lifespan of approximately 40 months. They can provide more detailed information on movements and range use. GPS collars are also equipped with a release mechanism.

VHF collars (Telonics MOD600) were deployed in January 2006. They look similar to ST-20 collars except they have no satellite beacon. We must fly to locate these collars with a receiver and antenna system (Fig. 1). They are equipped with a sensor indicating the collar has not moved (presumed dead caribou). Because you must fly to locate these animals they provide limited information on range use but provide information on adult and calf survival and calf production. These collars are also equipped with a release mechanism.

Figure 1. Danny Allaire using a receiver and antenna to locate a downed collar.

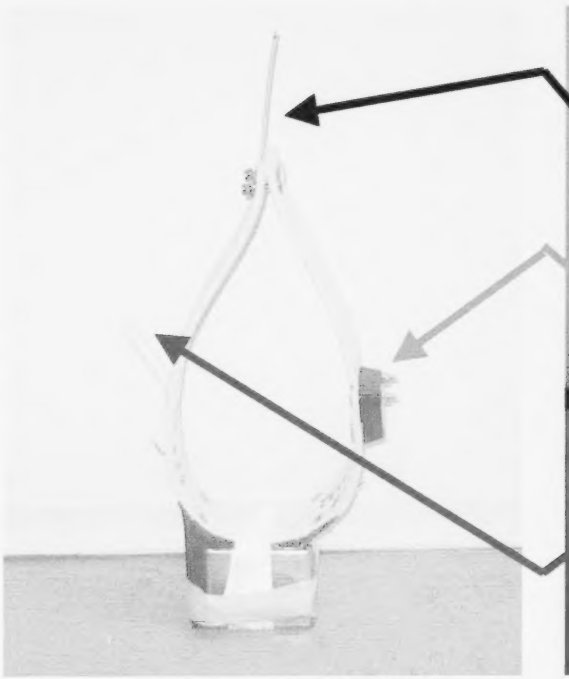

Figure 2. Telonics ST-20 satellite collar teardrop design with release mechanism (red arrow), satellite beacon (blue arrow) and VHF beacon (**black** arrow).

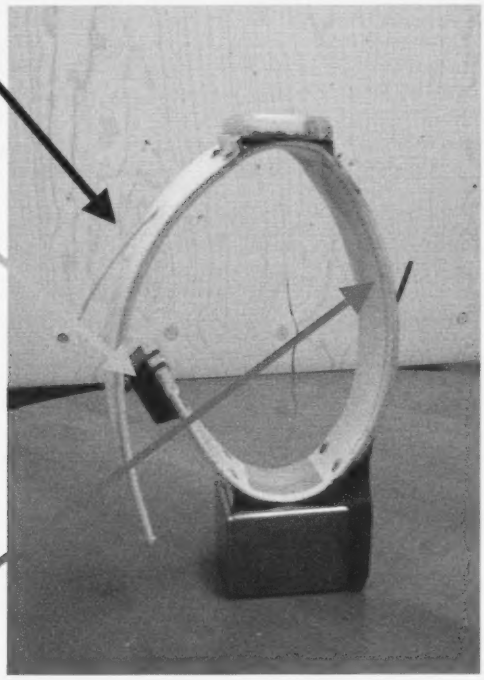

Figure 3. Telonics TGW-3680 GPS collar standard design with release mechanism (red arrow), satellite beacon (blue arrow), VHF beacon (**black** arrow) and a GPS antenna (top of collar).

Collar Deployments

Collars have been deployed annually since 2004 (Table 1); 61 boreal caribou females from throughout the Dehcho have been fitted with collars (Figs 4 and 5). All caribou have been captured by net-gunning the animal from a helicopter. ENR contracts a professional net-gunning crew, which must follow strict animal care guidelines, to do the work (GNWT Animal Care Committee Standard Operating Procedures for handling caribou). Blood, an ear plug, and feces are collected from each captured animal as long as the opportunity arises. Capture crews are directed to areas requested by First Nations where collared caribou are residing for the deployments. Aerial fixed-wing reconnaissance immediately prior to the capture operation was conducted with the initial deployments in 2004 and 2005 but now such reconnaissance is only done at the specific request of First Nations in order to minimize animal harassment. No animal has been injured during capture operations.

Table 1. The number and type of collars deployed in each year.

	Satellite (ST-20)	GPS (TGW-3680)	VHF (Mod 600)
March 2004	10		
March 2005	13		
January 2006	9		4
January 2007	8	9	
February 2008	4	4	
TOTAL	44	13	4

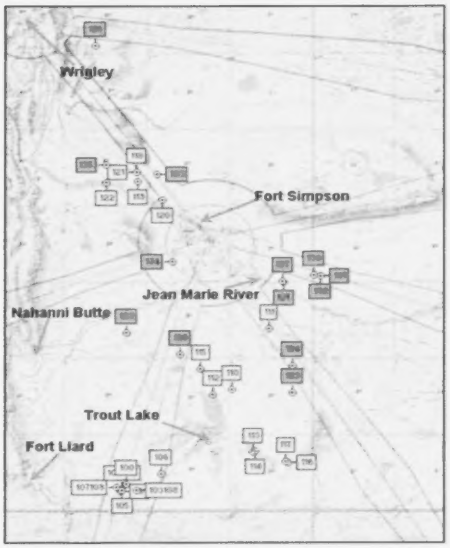

Figure 4. The locations of 36 female boreal caribou collared in , , 2006 (see colour for locations).

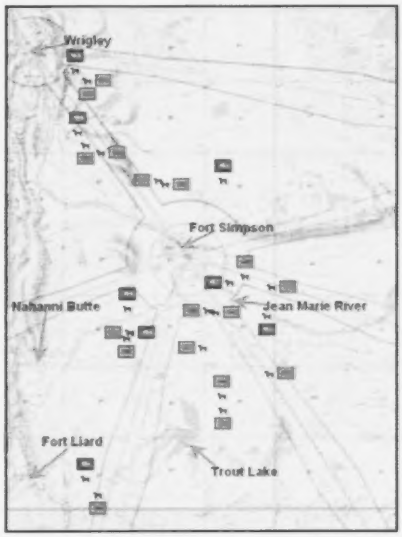

Figure 5. The locations of **25** female boreal caribou collared in 2007 and 2008 (see colour for locations).

Results

Home Ranges and Movements

We now have 41 collared animals (satellite and GPS) for which we have locations over one entire year including 12 animals with a minimum 24 months of location data. We calculated the 100% minimum convex polygon (a line connecting all of the outside points where a caribou was located) for these 41 female caribou (Fig. 6). The mean cumulative home range was 2180km^2 with a range of 205-7080 km^2, median 1766 km^2. Seven animals have ranged into northeastern British Columbia (see Fig. 6). One caribou that was originally collared in the South Slave study and re-collared in February

2007 near Trainor Lake (caribou #149) was not included in this analysis. Home range sizes we report are similar to those from a Cameron Hills study (Johnson 2007) but somewhat smaller than those reported for the Lower Mackenzie Valley study area (Nagy et al. 2005).

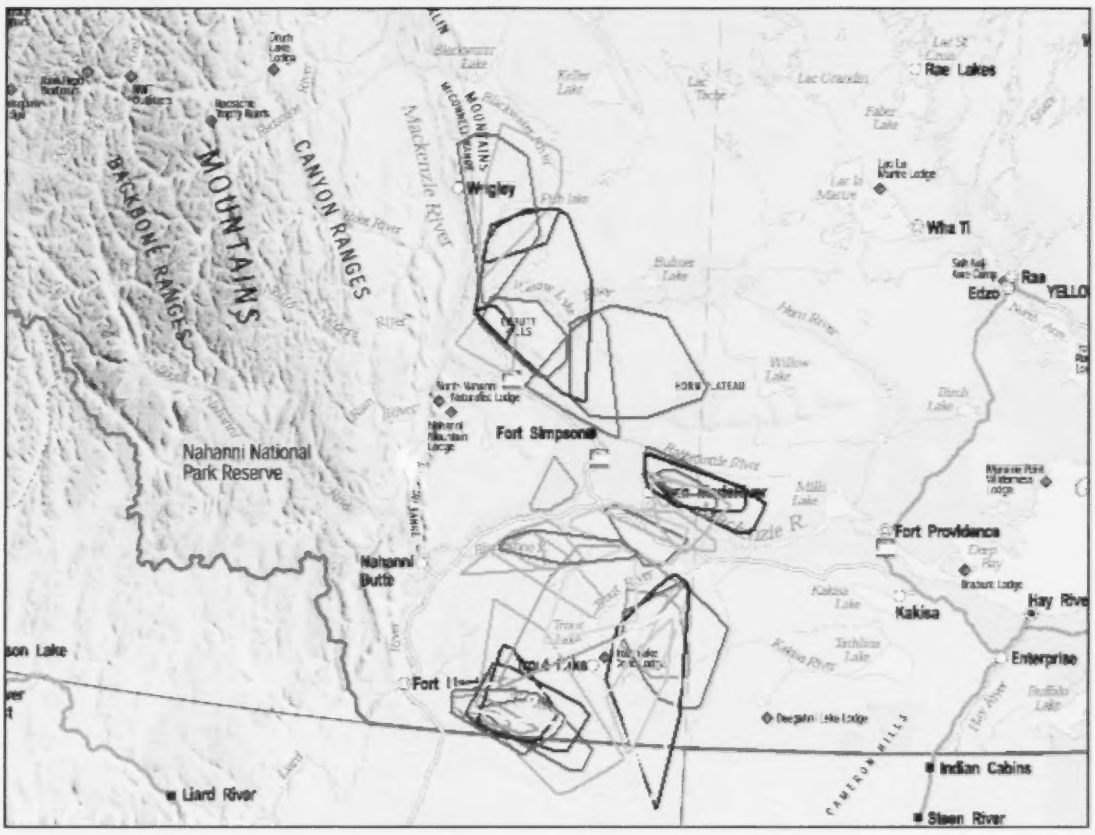

Figure 6. Minimum convex polygon estimates of the home ranges of 41 collared female boreal caribou.

Female boreal caribou are widely dispersed, found in small groups (1 or 2 adult females), and have limited movements during the calving/post-calving period and throughout the summer (Johnson 2007; Larter and Allaire 2006a; b; Nagy et al. 2005). Movements increase and group size increases during the fall/rut (1 September – 15 October) as females and males are found together. During winter (16 October – 30 April) we find the largest group sizes but caribou are still found in small groups (3-5 animals). The greatest directional movements occur during early (November) and late (April) winter.

Caribou #149

Originally collared in the Cameron Hills study area (Fig. 7). This animal later moved up into the Dehcho study area where she was re-captured and a new collar was deployed on her in February 2007. Her cumulative range (100% minimum convex

polygon) between the study areas is 10,630km^2 with a range of 6391km^2 in the Cameron Hills and 3289 km^2 in the Dehcho study areas.

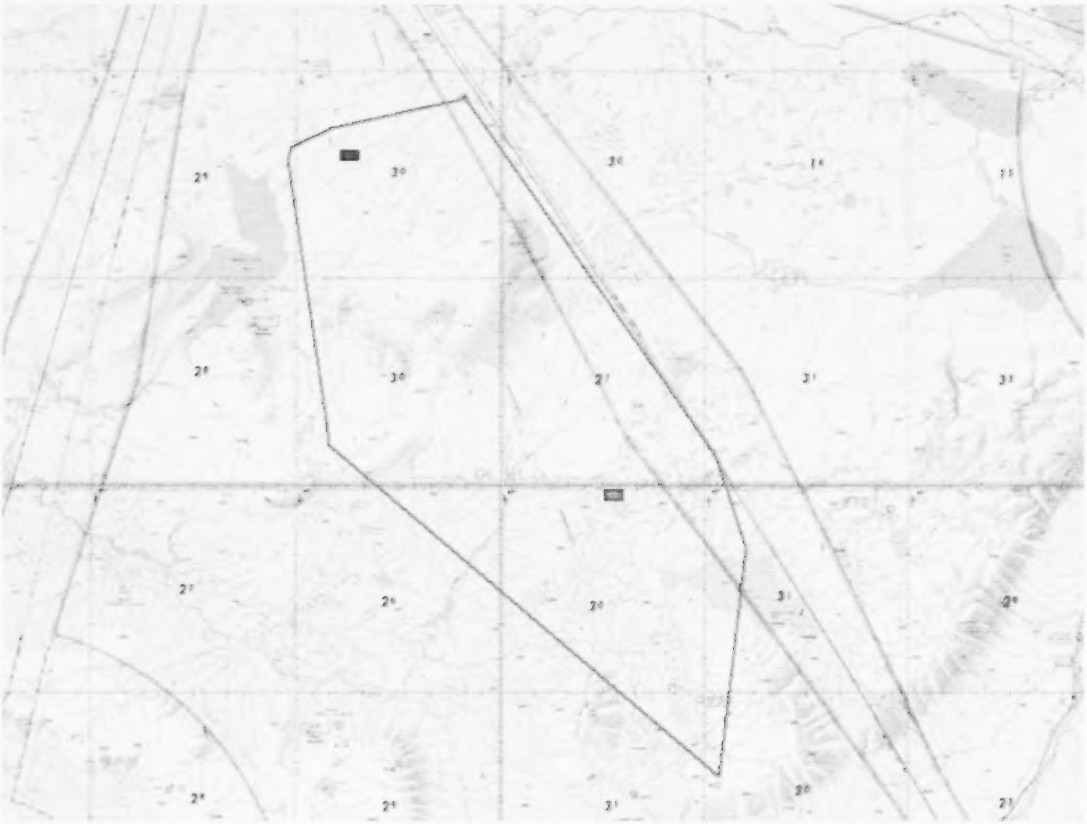

Figure 7. The 100% minimum convex polygon of caribou #149. ▪ is the location where she was initially collared (10 March 2005) and ▪ is the location where she was re-collared (24 February 2007).

Relocation Flights – primarily for VHF collared animals

From 23 April 2007 to 31 March 2008 we attempted 18 flights primarily to locate the 4 female caribou with VHF collars. The goal was to locate these animals at least once a month. Although the collars were deployed on caribou in the vicinity of Fort Simpson and Jean Marie River these animals ranged over large areas. One of these collared females died in May. Flights were primarily flown with fixed-wing aircraft (Cessna 172 or 185) generally at a high elevation because visual observations are not necessary. Opportunistic flights were made associated with fire operations. A brief account of each flight can be found in Appendix 1.

May/June Cow/Calf Surveys

These surveys are conducted with helicopter because their goal is to locate all collared caribou and determine whether or not they have newborn calves with them. All caribou and other wildlife observed on these surveys are recorded (Table 2). This provides us with an estimate of annual calf production. Neonatal deaths and late born calves cannot be detected with this survey. Surveys were completed 29-30 May 2006 and 29-30 May 2007. We located all 22 caribou with functioning collars in 2006 and all 30 caribou with functioning collars in 2007. Caribou were widely distributed in both surveys requiring 1900 and 1800km of flight lines respectively.

Table 2. Cow/calf survey results from 2006 and 2007.

	2006	2007
Total number caribou observed	45	74
Number of female caribou	27	42
Number of calf caribou	16	28
Number of calves per 100 female caribou	56.2	66.7
Number of collared caribou with calves	12	19
Number of calves per 100 collared female caribou	54.5	65.5
Number of male caribou	0	2
Number of yearling caribou	0	1
Number unknown sex/age class caribou	2	1
Number of moose observed	2	7
Number of black bear observed	1	3

February/March Classification Surveys

We assumed that calves of the year observed in late winter would be recruited into the population. Surveys are conducted with a helicopter because we require visual observations of all collared caribou and any animals associated with these animals. Photographs of caribou groups are taken to verify the presence of calves. During this survey we have observed calves with collared caribou that did not have calves with them during the post calving survey. All caribou and other wildlife observed on these surveys are recorded (Table 3). Surveys were completed on 1-2 March, 2006, 26-27 February, 2007 and 3-5 March, 2008 with 170, 216 and 241 caribou classified, respectively. We located all caribou with properly functioning VHF beacons, 24 in 2006, 33 in 2007, and 35 in 2008. Caribou were widely distributed requiring flight lines of approximately almost 1200km, 1600km and 1700km in 2006, 2007 and 2008 respectively. Caribou were classified into calves (8-10 months old), yearlings (20-22 months old), females ($\geq$32 months old), and males ($\geq$32 months old). Some yearlings may have been misclassified as females or males $\geq$32 months old.

Table 3. The number of caribou classified and other wildlife observed during caribou sex/age classification surveys in 2006-2008.

	2006	2007	2008
Total number caribou observed	170	216	241
Number of female caribou	94	114	145
Number of calf caribou (8-10 months old)	27	26	34
Number of yearling caribou (20-22 months old)	13	6	1
Number of male caribou	35	70	61
Number unknown sex/age class caribou	1	0	0
Number of calves per 100 female caribou	28.7	22.8	23.4
Number of moose observed	18	38	15
Number of wolves observed	2	1	0

Of the 11 collared female caribou that we know had calves in May 2005 (based upon a limited fixed-wing survey), 8 (72.7%) were observed with calves in the March 2006 classification survey. Of the 13 collared female caribou that we know had calves in May 2006, 6 (46.2%) were observed with calves in the February 2007 classification survey. Of the 21 collared female caribou that we know had calves in May 2007, 8 (38.0%) were observed with calves in the March 2008 sex/age classification survey. The number of calves per 100 adult females that we report in February/March is slightly higher than that reported for caribou in the adjacent Cameron Hills study area (Johnson 2007), but much lower than the 50-66 reported for caribou in the northern range of the Lower Mackenzie Valley study area near Tsiigehtchic (J. Nagy unpubl. data). Wolf predation on boreal caribou in the Lower Mackenzie Valley is negligible unlike in the Cameron Hills and Dehcho study areas (Johnson 2007; J. Nagy pers. comm.). Now we have had collared caribou distributed widely throughout the Dehcho region for over 2 years, there is some indication that population characteristics may be different for caribou that were collared north of the Mackenzie River from those collared south of the Mackenzie River.

Mortalities

Since April 2007, 4 collared caribou have died and we have successfully retrieved all 4 of these collars. Two caribou were likely killed by wolves, one caribou was shot, and another was killed by a black bear. We have successfully retrieved collars from all caribou that have died since the start of the study. Of the 22 mortalities there is strong evidence that 18 resulted from wolf predation and 1 resulted from bear predation; 1 caribou was shot, and 2 died of natural causes associated with old age. Some of these mortalities occurred near prominent game trails not associated with seismic activity. The majority of mortalities (18 of 22) have occurred between late-March and mid-July in any year, a similar time period when the majority of female mortalities have occurred in the Cameron Hills study area (Johnson 2007). The other mortalities occurred in September (1), October (1) and November (2).

Teeth have been retrieved from 10 of the 22 mortalities. To date 9 teeth have been forwarded to Matson's Laboratory for aging. Age is determined based upon counting cementum annuli on preferably the incisor teeth, similar to counting the rings of a tree. 1 June is used as the birth date for caribou (Matson 1981). The age range is from 5 to 17 (median age 11 years; Fig. 8). These are some surprising old ages. Also of note is that blood test results indicated that 5 of the collared female caribou were pregnant at 10, 10, 14, 14, and 16 years of age.

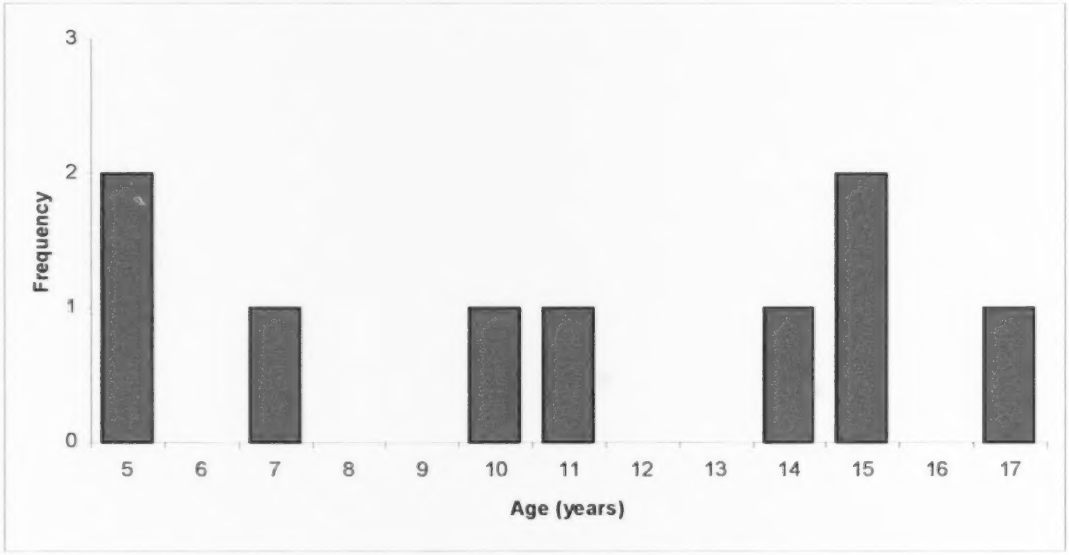

Figure 8. The ages of 9 female boreal caribou at the time of their death rounded down to the nearest year. Age determined by counting cementum annuli of teeth.

Adult Female Survival

Based upon the number of collared caribou that have died during the course of the study to date (Kaplan and Meier 1958; Pollock et al. 1989) our best estimate of mean adult survival over 3 years pooled across the entire study area is 76%. There has been yearly variation in adult female survival and there may be an indication that population demographics are somewhat different for caribou collared north of the Mackenzie River compared to caribou collared south of the Mackenzie River (Table 4.) The annual adult female survival ranges from 60-81% for female caribou north of the Mackenzie River and from 63-94% for caribou south of the Mackenzie River. Overall throughout the Dehcho, adult female survival is low and less than that reported in the Cameron Hills (Johnson 2007) and Lower Mackenzie (Nagy et al. 2005) study areas.

Estimated Population Rate of Increase

We estimated the population rate of increase measured from 1 April to 31 March for 3 successive years for the entire study area and also separated out for caribou north

and south of the Mackenzie River. We based the estimate on the annual female survival and the ratio of calves per 100 adult females (Hatter and Bergerud 1991). A rate of increase, or λ, of 1 indicates population stability, <1 indicates population decrease, and >1 indicates population increase. Small sample sizes affect the confidence of the estimate, but λ values have generally been <1 (Table 4).

Table 4. The population rate of increase (λ) estimated for 3 successive years in the Dehcho. The north-south boundary is the Mackenzie River.

South Dehcho

Year	Female Survival Rate	Ca:100 Females	Rate of Increase (λ)
2005-2006	0.6250	0.2587	0.7179
2006-2007	0.6429	0.2616	0.7396
2007-2008	0.9375	0.2558	1.0750

North Dehcho

Year	Female Survival Rate	Ca:100 Females	Rate of Increase (λ)
2005-2006	0.6000	0.3318	0.7193
2006-2007	0.7500	0.1999	0.8333
2007-2008	0.8125	0.1937	0.8996

Dehcho Combined

Year	Female Survival Rate	Ca:100 Females	Rate of Increase (λ)
2005-2006	0.6191	0.2881	0.7232
2006-2007	0.6923	0.2286	0.7817
2007-2008	0.8750	0.2335	0.9906

Response to Anthropogenic Linear Features

Recent analyses of location data obtained for boreal caribou outfitted with GPS collars in the Lower Mackenzie (LM), Dehcho (DC), and Cameron Hills (CH) study areas, indicate that seismic lines are barriers to the movement of caribou. Caribou used areas near seismic lines less than expected if they had used areas within their home ranges randomly (Nagy et al. in prep. a). Caribou showed reduced use of areas near seismic lines from 500m (LM), to 250m (DC), and to 100m (CH) as the density of seismic lines increased within their home ranges (Nagy et al. in prep. a). Caribou also crossed seismic lines less frequently than expected if their movements had been random within their home ranges (Nagy et al. in prep. a). For caribou in stable or increasing populations, $<20\%$ of their annual home ranges were within 250m of linear developments and the density of seismic lines in their annual home ranges was <0.5km per km^2 (Nagy et al. in prep. b.).

Although the DC is relatively pristine, the Dehcho Land Use Plan (DLUP) indicates a noticeable linear footprint on the landscape. Based upon the DLUP digital linear footprint files we calculated the distance of caribou mortalities from the nearest linear feature. Seismic lines do not kill caribou, predators that travel these lines do. Of 18

mortalities related to wolf or bear predation, 7 (38.9%) occurred within 500m of a linear feature (Table 5.). The 2 animals whose death was not related to predation died 150 and 200m from the nearest linear feature. There is a much higher impact of predators in the DC likely because there is a diversity of prey. A greater number of predators traveling the same amount of linear features would have more of an impact on the caribou population. This may be why the caribou population(s) in the DC indicate a λ indicating population decrease.

Table 5. The number of caribou kills, related to wolf or bear predation, found from various distances (in metres) to the nearest linear feature. The linear features are based upon the the DLUP linear footprint.

Distance from DLUP Linear Feature (m)	<100	100-250	251-500	501-1000	>1000
Number	2	3	2	4	7

Disease and Parasites

Blood and fecal samples have been analyzed for the presence of diseases and parasites. Minor infestations of the eggs of *Ostertagia* have been found in 41 of 56 (73%) fecal samples. *Giardia* and *Cryptosporidium* eggs have been found in 2 (4%) and 3 (5%) of 56 fecal samples, respectively. All 22 blood samples were negative for *Brucella*, with 6 (27%) indicating exposure to herpesvirus. From 8 fecal samples collected opportunistically during the Sambaa K'e track count project this winter 1 had eggs of *Ostertagia* and one had eggs of lungworm (*Parelaphostrongylus odocoilei*).

Miscellaneous Topics and Findings of Note

Calving Fidelty

Some female caribou certainly show fidelity to calving areas by calving in roughly the same location in successive years, but that is not the case for all collared females.

Collar Issues

Two of the collars deployed in March/April 2004 continue to provide inconsistent satellite transmissions during part of the winter. We have been working with the manufacturing company to try and determine the cause(s) and rectify the situation without success. The manufacture has modified our refurbished collars at their expense and has offered to refurbish the malfunctioning units at no charge if we can retrieve them. Currently we have been unable to retrieve any of these collars.

The life span of collars deployed in 2005 and 2006 is nearing an end. Beginning in March-April 2009 and continuing again in June-September 2010 large numbers of

collars will be released and their transmissions ceasing. We will attempt to retrieve as many of these collars as is logistically feasible so they can be refurbished and made available for redeployment. The loss of these collars will reduce the number of collared female caribou in the program. In order for continued population monitoring we would need to maintain a minimum number of collared females. Whether these collars are GPS, satellite, and VHF in any combination is a topic that needs to be addressed. Ideally we suggest maintaining 30-35 collars throughout the study area.

However, if there is evidence that population parameters are different for boreal caribou collared north of the Mackenzie River versus those collared south of the Mackenzie River, then we would ideally need to deploy 25-30 collars on females residing on the north and 25-30 collars on females residing on the south side of the Mackenzie River. Again the number and type of collars deployed needs to be addressed based upon the questions we want answered. We hope to have discussion on these issues 4th Biannual Dehcho Regional Wildlife Workshop in Fort Simpson, October 2008, so that some clear goals and objectives are formulated.

Co-operative Work Projects

Over the past 2 winters Sambaa K'e Dene Band (SKDB) has been conducting a track counting program, which ENR initially assisted with. Caribou fecal samples have been collected opportunistically during the track count program and SKDB has made these samples available to ENR. ENR has forwarded these samples for disease and parasite analysis in addition to those samples collected from captured caribou. ENR will be co-operatively sharing the sample analysis results and location information from caribou found in the track counting study area.

All location data from this study is being combined with location data from the Cameron Hills and Lower Mackenzie studies so that we can get a better idea of how boreal caribou use their range on a seasonal basis and how range use is modified by different current levels of disturbance throughout the range of boreal caribou in the Northwest Territories. We continue to work co-operatively with the researchers conducting these studies in the Inuvik and South Slave Regions.

Deliverables

ENR continues to provide quarterly maps to its First Nations partners. The maps show the ranges used by each individual collared caribou over the previous 3 months.

Posters outlining the Dehcho boreal caribou program and preliminary results were presented at the Science in the Changing North Conference in Yellowknife.

Acknowledgements

We would like to thank John Nagy and Deborah Johnson for stimulating conversations, provision of data from their programs, critical reviews and assistance with the Dehcho Boreal Caribou Program. We thank Forest Management, Fort Simpson, for providing access to helicopter time, particularly for collar retrieval, and providing fuel for survey and capture operations. Pathfinder and Diversified Environmental Services captured and deployed collars on boreal caribou. CLS America provided all satellite location data. Matson's Laboratory aged all the teeth. Bow Valley Research analyzed fecal samples for disease and parasite presence. Simpson Air, Wolverine Air, Canadian Helicopters and Great Slave Helicopters have provided aircraft for various aspects of the study. Funding for the program came from ENR Wildlife, the Western Northwest Territories Biophysical Study (GNWT), and the Cumulative Impact Monitoring Program (DIAND).

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Personal Communications

John Nagy, Senior Wildlife Researcher, Mackenzie Valley Development, ENR

Appendix 1. Brief descriptions of relocation and collar retrieval flights conducted since from April 2007 to March 2008.

All relocation flights.

- On 23 April, 2007, we used a fixed-winged aircraft to relocate #132,133,134, and 135.
- On 22 May, we used a fixed-winged aircraft to relocate #132, 133, 134 and 135.
- On 29-30 May we used a helicopter to relocate and get visual observations of 30 of 33 caribou with functioning collars. We also made visual observations of collars by the remains of caribou #141 and 135, 135 was killed by a bear.
- On 20 June we used a fixed-winged aircraft to relocate #132, 133 and 134.
- On 31 July we used a fixed-wing aircraft to relocate #132, 133 and 134.
- On 2 August we used a forestry helicopter to relocate #133 on the way to Wrigley for fire operations.
- On 29 August we used a fixed-winged aircraft to relocate #132, 133, 134 and checked on FS-028 for the fire operations.
- On 18 September we used a fixed-wing aircraft to relocate #132, 133 and 134.
- On 23 October, we used a fixed-wing aircraft to relocate #132, 133 and 134.
- On 15-21 November we used a fixed-winged aircraft during our moose survey to relocate 132, 133, 134, 140and 143, 143 wasn't giving us any satellite locations recently and 140 died east of the Enbridge Pipeline ROW.
- On 6 December, we used a fixed-wing aircraft to relocate #120, 131, 132, 134 and 143.
- On 7 December, we used a fixed-wing aircraft to relocate #120 and 133.
- On 25 January, we used a fixed-winged aircraft to relocate #132, 134 and 143. We were not able to relocate #133.
- On 5 February we used a fixed-winged aircraft to relocate #132 and 152.
- On 15 February we used a fixed-winged aircraft to relocate #132, 134, and 143. We were not able to relocate #133.
- On 26-27 February we used a helicopter to relocate 33 animals with active collars and conduct a sex/age classification survey.
- On 26 March we used a fixed-wing aircraft to relocate #132, 134 and 143.
- On 27 March we were not able to relocate #133.
- A fixed-wing flight is planned for 21 April to relocate VHF collared animals.

All flights to retrieve collars from dead animals.

- On 21 May we drove on Highway #1 to retrieve the collar from VHF #135. We had to walk off the highway with shotguns in case the black bear was still in the vicinity.
- On 13 July we used a helicopter to retrieve the collar from #141.

Appendix 2. A time line of each collared caribou since 2004.

Animal # 100

- 29 March/04 collared
- 29 May/04 seen in group of 3 (no calf)
- 3 June/04 seen alone (no calf)
- 22 Sept/04 no visual
- 25 Jan/05 seen in group of 11, no calf
- 31 May/05 seen in group of 3 with calf
- 19 June/05 seen alone (no calf)
- 23 Sept/05 a problem with VHF reception
- 30 Oct/06 a problem with satellite signal reception
- 6 Feb/06 no satellite/VHF signal
- 27 Feb/07 no visual
- 30 May/07 no visual
- 15 June/07 collar finished transmitting

Animal # 101

- 30 March/04 collared
- Died during month of May/04, likely wolf predation
- 9 August/04 collar retrieved

Animal #102

- 29 March/04 collared
- Died 14-15 May/04, wolf predation
- 3 June/04 collar retrieved

Animal #103

- 1 April/04 collared
- 29 May/04 seen in group of 3 with calf
- 3 June/04 not checked on
- 22 Sept/04 no visual
- 25 Jan/05 not checked on
- Died 25-30 April/05, likely wolf predation
- 4 May/05 collar retrieved

Animal #104

- 29 March/04 collared
- 29 May/04 seen in group of 3 (no calf)
- 3 June/04 seen in group of 3 (no calf)
- 22 Sept/04 no visual
- 25 Jan/05 not checked on
- Died 19-27 April/05, death probably related to old age
- 4 May/05 collar retrieved

Animal #105

- 30 March/04 collared
- 29 May seen in group of 3 with calf
- 3 June/04 not checked on
- 22 Sept/04 no visual
- 25 Jan/05 seen in group of 3 (no calf)
- 31 May/05 seen alone (no calf)
- 19 June/05 seen alone (no calf)
- 23 Sept/05 no visual
- 2 March/06 seen in group of 11 no calf
- 23 Aug/06 collar retrieved

Animal #106

- 30 March/04 collared
- 29 May/04 no visual
- 3 June/04 seen in group of 2 with calf
- 22 Sept/04 seen in group of 7 (no calf)
- 25 Jan/05 seen in group of 5 (no calf)
- 31 May/05 seen alone (no calf)
- 23 Sept/05 seen in group of 2 (no calf)
- Died 21-24 Nov/05, likely wolf predation

- 30 May/06 collar retrieved

Animal #107

- 1 April/04 collared
- 29 May/04 no visual
- 3 June/04 not checked
- 22 Sept/04 seen in group of 3 with calf
- 25 Jan/05 not checked
- Died 14-17 April/05 likely wolf predation
- 4 May/05 collar retrieved

Animal #108

- 1 April/04 collared
- 29 May/04 seen alone (no calf)
- 3 June/04 no visual
- 22 Sept/04 seen in group of 3 (no calf)
- 25 Jan/05 seen in group of 4 (no calf)
- 31 May/05 no visual
- 10 June/05 no visual
- 19 June/05 seen with calf
- 23 Sept/05 no visual
- 5 Oct/05 seen in group of 5 with calf
- 2 March/06 seen in group of 3 with yearling
- 30 May/06 seen with calf
- 23 Jan/06 seen in group of 5 with calf
- 27 Feb/07 seen in group of 11with calf
- 30 May/07 seen in group of 3 with calf
- 15 June/07 collar finished transmitting

Animal #109

- 1 April/04 collared
- 29 May/04 no visual
- 3 June/04 not checked on
- 22 September/04 seen in group of 4 (no calf)
- 25 Jan/05 not checked on
- 31 May/05 seen with calf
- 19 June/05 seen with calf
- 23 Sept/05 no visual
- 5 Oct/05 seen in group of 3 with calf
- Died 22-25 April/06, likely wolf predation
- 23 Aug/06 collar retrieved

Animal #110

- 5 March/05 collared
- 10 April/05 not checked on
- 5 May/05 seen alone (no calf)
- 31 May/05 seen alone (no calf)
- 10 June/05 not checked on
- Died 5-11 June/05 likely wolf predation
- 29 July/05 collar retrieved

Animal #111

- 3 March/05 collared
- 10 April/05 not checked on
- 5 May/05 seen in group of 2
- 31 May/05 seen with calf
- 10 June/05 not checked on
- 23 Sept/05 seen in group of 5 with calf
- 5 Oct/05 not checked on
- 1 March/06 seen in group of 9 no calf
- 29 May/06 seen with calf
- 16 Sept/06 seen in group of 3
- 24 Jan/07 seen in group of 14
- 27 Feb/07 seen in group of 4 with calf
- 30 May/07 seen with calf
- 4 March/08 seen in group of 8 with calf

Animal #112

- 3 March/05 collared

- 10 April/05 seen with calf
- 5 May/05 not checked on
- 31 May/05 seen with calf
- 10 June/05 seen with calf
- 23 Sept/05 no visual
- 5 Oct/05 not checked on
- 1 March/06 seen in group of 6 with calf
- 30 May/06 seen in group of 4 with calf
- 16 Sept/06 seen with calf
- 27 Feb/07 seen in group of 5 with calf
- 29 May/07 seen with calf
- 5 March/08 seen with 2 bulls

Animal #113

- 3 March/05 collared
- 10 April/05 seen in group of 4
- 5 May/05 not checked on
- 31 May/05 no visual
- 10 June/05 seen alone (no calf)
- Died 2-8 Sept/05 likely wolf predation
- 5 Oct/05 collar retrieved

Animal #114

- 3 March/05 collared
- 10 April/05 seen in group of 9
- 5 May/05 not checked on
- 31 May/05 no visual
- 10 June/05 seen alone (no calf)
- 23 Sept/05 no visual
- 5 Oct/05 not checked on
- 2 March/06 seen in group of 6 no calf
- 29 May/06 seen in group of 3 no calf
- 16 Sept/06 seen in group of 3 no calf
- 27 Feb/07 seen in group of 6 no calf
- 30 May/07 seen with no calf
- 4 March/08 seen in group of 7 no calf

Animal #115

- 3 March/05 collared
- 10 Apr/05 seen in group of 3
- 5 May/05 not checked on
- 31 May/05 seen alone (no calf)
- 10 June/05 not checked on
- 23 Sept/05 no visual
- 5 Oct/05 seen in group of 2 no calf
- 2 March/06 seen in group of 9 no calf
- 30 May/06 seen in group of 2 no calf
- 16 Sept/06 seen in group of 4 no calf
- 27 Feb/07 seen in group of 4 no calf
- 29 May/07 seen with calf
- 04 March/08 seen with 2 cows

Animal #116

- 3 March/05 collared
- 10 April/05 not checked on
- 5 May/05 not checked on
- 31 May/05 seen alone (no calf)
- 10 June/05 no visual
- 23 Sept/05 seen in group of 3
- 5 Oct/05 not checked on
- 26 Jan/06 seen in group of 7 with calf
- 2 March/06 seen in group of 4 with calf
- 29 May/06 seen with calf
- 16 Sept/06 seen in group of 2 no calf

- 23 Jan/07 seen in group of 12 no calf
- 27 Feb/07 seen in group of 6 no calf
- 30 May/07 seen in group of 3 with calf
- 4 March/08 seen with bull

Animal #117

- 3 March/05 collared
- 10 April/05 not checked on
- 5 May/05 not checked on
- 31 May/05 seen alone (no calf)
- 10 June/05 seen in thick brush
- 23 September/05 seen in group of at least 4
- 5 Oct/05 not checked on
- 26 Jan/06 seen in group of 4 with calf
- 2 March/06 seen in group of 5 with calf
- Died 17-21 April/06
- 28 Aug/06 collar retrieved

Animal # 118

- 4 March/05 collared
- 21 March/05 seen in group of 10
- 30 March/05 seen in group of 9
- 1 June/05 no visual
- 4 June/05 no visual
- Died 15-21 June/05, likely wolf predation
- 6 Sept/05 collar retrieved

Animal # 119

- 4 March/05 collared
- 21 March/05 seen in group of ≥ 8
- 30 March/05 no visual
- 1 June/05 seen alone (no calf)
- 23 Sep/05 no visual
- 10 Oct/05 no visual
- 16 Jan/06 in group of 5 no calf
- 1 March/06 in group of 4
- 30 May/06 with calf
- 22 Jan/07 in group of 3 with calf
- 26 Feb/07 in group of 11 with calf
- 29 May/07 seen with no calf
- 3 March/08 seen with cow

Animal #120

- 4 March/05 collared
- 21 March/05 seen in group of 13
- 30 March/05 seen in group of 3
- 1 June/05 no visual
- 4 June/05 seen alone (no calf)
- 23 Sept/05 seen in group of 14
- 10 Oct/05 no visual
- 16 Jan/06 seen in group of 3
- 1 March/06 seen in group of 5
- 30 May/06 no calf
- 26 Feb/07 seen in group of 10 no calf
- 30 May/07 seen with no calf
- 7 Dec/07 seen in group of 4 no calf
- 3 March/08 seen in group of 4 no calf

Animal #121

- 4 March/05 collared
- 21 March/05 seen in group of 3
- Died 26-27 March predated by wolves
- 30 March/05 collar retrieved

Animal # 122

- 4 March/05 collared

- 21 March/05 seen in group of 3
- 30 March/05 seen in group of 3
- 1 June/05 seen alone (no calf)
- 4 June/05 no visual
- 23 Sept/05 no visual
- 10 Oct/05 no visual
- 31 Nov/05 no satellite signal
- 4 April/05 got satellite signal back
- 30 May/05 seen no calf
- 24 Nov/06 no satellite signal
- 15 June/07 collar finished transmitting

Animal #123
- 20 Jan/06 collared
- 2 March/06 seen in group of 4 with calf
- 29 May/06 no calf
- 16 Sept/06 seen in group of 3
- Died 1-5 Nov/06 on Trainor Lake
- 15 Feb/07 locate collar in ice
- 27 Feb/07 collar retrieved

Animal #124
- 20 Jan/06 collared
- 2 March/06 seen in group of 7 no calf
- Died 13-19 May/06, likely wolf predation
- 23 Aug/06 collar retrieved

Animal #125
- 22 Jan/06 collared
- 1 March/06 seen in group of 16 with yearling
- 29 May/06 seen with small calf
- Died 12-15 July/06, likely wolf predation
- 16 Sept/06 no visual
- 23 Oct/06 collar retrieved

Animal #126
- 21 Jan/06 collared
- 1 March/06 seen in group of 5 with yearling
- 30 May/06 seen with calf
- 26 Feb/07 seen in group of 13 no calf
- 29 May/07 seen with no calf
- 03 March/08 seen in group of 14 no calf

Animal #127
- 22 Jan/06 collared
- 1 March/06 seen in group of 7 with calf
- 29 May/06 seen with calf
- Died 1-5 July/06, likely wolf predation
- 16 Sept/06 confirm carcass
- 23 Oct/06 collar retrieved

Animal #128
- 20 Jan/06 collared
- 2 March/06 seen in group of 5 no calf
- 30 May/06 seen in group of 4 with calf
- 16 Sept/06 seen in group of 3 no calf
- 27 Feb/07 seen in group of 5 no calf
- 29 May/07 seen with calf
- 04 March/08 seen in group of 10 with calf

Animal #129
- 20 Jan/06 collared
- 1 March/06 seen in group of 6 no calf
- 30 May/06 seen with calf
- 16 Sept/06 with calf
- 21 Jan/07 seen in group of 4 with calf

- 26 Feb/07 seen in group of 10 with calf
- 29 May/07 seen with calf
- 05 March/08 seen with no calf

Animal #130
- 22 Jan/06 collared
- 1 March/06 seen in group of 7 no calf
- 29 May/06 no calf
- Died 1-7 July/06
- 23 Aug/06 collar retrieved

Animal #131
- 22 Jan/06 collared
- 1 March/06 seen with calf
- 29 May/06 no calf
- 16 Sept/06 seen in group of 3 no cows
- 21 Jan/07 seen in group of 5 with calf
- 27 Feb/07 seen in group of 5 no calf
- 30 May/07 seen with calf
- 03 March/08 seen in group of 8 with calf

Animal #132
- 22 Jan/06 collared
- 1 March/06 seen in group of 9 with calf
- 29 May/06 approx. location not pregnant
- 16 Sept/06 seen in group of 2 no calf
- 26 Feb/07 seen in group of 3 no calf
- 30 May/07 seen with calf
- 15 Feb/08 seen in group of 5 no calf
- 4 March/08 seen in group of 5 no calf

Animal #133
- 21 Jan/06 collared
- 1 March/06 seen with calf
- 30 May/06 seen with calf
- 23 Jan/07 seen in group of 10 no calf
- 26 Feb/07 seen in group of 3 no calf
- 29 May/07 seen with calf

Animal #134
- 21 Jan/06 collared
- 1 March/06 seen in group of 3
- 29 May/06 seen with calf
- 16 Sept/06 seen in group of 4
- 26 Feb/07 seen in group of 2 no calf
- 29 May/07 seen with no calf
- 15 Feb/08 seen in group of 13 no calf
- 4 March/08 seen in group of 24 no calf

Animal #135
- 21 Jan/06 collared
- 1 March/06 seen in group of 4 no calf
- 30 May/06 no calf
- 28 Sept/06 no visual
- 23 Feb/07 seen in group of 6 no calf
- Died 23-28 May/07
- 31 May/07 collar retrieved

Animal #136
- 23 Jan/07 collared
- 26 Feb/07 seen in group of 5 no calf
- 29 May/07 seen with no calf
- 5 March/08 seen in group of 19 with no calf

Animal #137
- 23 Jan/07 collared

- 27 Feb/07 seen in group of 5 no calf
- 29 May/07 seen with calf
- 5 March/08 seen with calf

Animal #138
- 23 Jan/07 collared
- 27 Feb/07 seen in group of 4 no calf
- 30 May/07 seen with no calf
- 4 March/08 seen in group of 8 with no calf

Animal #139
- 21 Jan/07 collared
- 27 Feb/07 seen in group of 6 no calf
- 30 May/07 seen in group of 4 with calf
- 3 March/08 seen with calf

Animal #140
- 24 Jan/07 collared
- 26 Feb/07 seen in group of 3 no calf
- 30 May/07 seen with no calf
- Died 30 Oct-4 Nov/07
- Collar not retrieved yet

Animal #141
- 23 Jan/07 collared
- 26 Feb/07 seen in group of 2 no calf
- Died 27-31 May/07
- 13 July/07 collar retrieved

Animal #142
- 22 Jan/07 collared
- 26 Feb/07 seen in group of 10 no calf
- 29 May/07 seen with calf
- 3 March/08 seen in group of 4 with no calf

Animal #143
- 21 Jan/07 collared
- 26 Feb/07 seen in group of 6 no calf
- 29 May/07 seen with calf
- 20 Nov/07 seen in group of 4
- 04 Sept/07 lost satellite
- 4 March/08 seen in group of 6 with no calf

Animal #144
- 23 Jan/07 collared
- 26 Feb/07 seen in group of 10 no calf
- Died 5-6 April/07 shot by WY chief
- 12 April/07 collar retrieved

Animal #145
- 21 Jan/07 collared
- 27 Feb/07 seen in group of 3 no calf
- 30 May/07 seen with no calf
- 3 March/08 seen in group of 4 with calf

Animal #146
- 21 Jan/07 collared
- 27 Feb/07 see in group of 11 with calf
- 30 May/07 seen with calf
- 4 March/08 seen in group of 4 with calf

Animal #147
- 22 Jan/07 collared
- 26 Feb/07 seen in group of 8 no calf
- 30 May/07 seen with no calf
- 3 March/08 seen in group of 9 with no calf

Animal #148
- 24 Jan/07 collared
- 26 Feb/07 seen in group of 12 no calf

- 30 May/07 seen with no calf
- 4 March/08 seen with calf

Animal #149
- 24 Feb/07 collared
- 27 Feb/07 seen in group of 7 no calves
- 30 May/07 seen with calf
- 4 March/08 seen in group of 10 with no calf

Animal #150
- 22 Jan/07 collared
- 26 Feb/07 seen in group of 2 no calf
- 29 May/07 seen with calf
- 3 March/08 seen with cow

Animal #151
- 22 Jan/07 collared
- 26 Feb/07 seen in group of 6 no calf
- 29 May/07 seen with calf
- 3 March/08 seen in group of 8 with no calf

Animal #152
- 23 Jan/07 collared
- 27 Feb/07 seen in group of 6 no calf
- 30 May/07 seen with calf
- 4 March/08 seen with cow

Animal #153
- 16 Feb/08 collared with calf
- 4 March/08 seen in group of 4 with no calf

Animal #154
- 17 Feb/08 collared
- 5 March/08 seen in group of 19 with no calf

Animal #155
- 17 Feb/08 collared
- 3 March/08 seen in group of 6 with no calf

Animal #156
- 18 Feb/08 collared with calf
- 4 March/08 seen in group of 4 with calf

Animal #157
- 17 Feb/08 collared
- 3 March/08 seen in group of 5 without calf

Animal #158
- 17 Feb/08 collared
- 3 March/08 seen with cow

Animal #159
- 16 Feb/08 collared
- 4 March/08 seen in group of 24 with no calf

Animal #160
- 17 Feb/08 collared with calf
- 3 March/08 seen in group of 5 with calf